

BUREAU OF DESIGN AND ENVIRONMENT MANUAL

Chapter Thirteen WORK ZONE TRAFFIC MANAGEMENT STUDIES

Table of Contents

<u>Section</u>	<u>on</u>		<u>Page</u>
13-1	GENERAL		13-1(1)
		trol Plans (TCP)	
	13-1.04 TMA Devel	opment	13-1(2)
	13-1.04(a)	Procedure	13-1(2)
	13-1.04(b)	TMA Team	13-1(3)
13-2	TRAFFIC CONTRO	L MANAGEMENT	13-2(1)
	13-2.01 Terminolog	у	13-2(1)
	13-2.02 Work Zone	Type	13-2(1)
	13-2.03 Work Zone	Traffic Control Strategies	13-2(9)
	13-2.03(a)	Objectives	13-2(9)
	13-2.03(b)	Selection	13-2(9)
13-3	TRAFFIC MANAGE	MENT ANALYSIS STRATEGIES	13-3(1)
	13-3.01 Construction	on Phases	13-3(1)
	13-3.01(a)	Reconstruction by Halves (Sides)	13-3(1)
	13-3.01(b)	Parallel/Adjacent Reconstruction	13-3(2)
	13-3.01(c)	Serial/Segmental Reconstruction	13-3(2)
	13-3.01(d)	Complete Closure (Detour)	13-3(3)
	13-3.01(e)	Combinations	13-3(3)
	13-3.02 On-Site Str	rategies	13-3(4)
	13-3.02(a)	Traffic Control Devices	13-3(4)
	13-3.02(b)	Capacity	13-3(4)
	13-3.02(c)		
	13-3.03 Off-Site Str	ategies	13-3(6)
	13-3.05 Public Relations/Information		

Table of Contents (Continued)

<u>Section</u>	<u>on</u>		<u>Page</u>
13-4	COST-EFFECTIVE ANALYSES		
		ations	
	13-4.02(b)	On-Site Detours Detour User Costs	13-4(1)
13-5	TRAFFIC MANAGEMENT ANALYSIS REPORT		13-5(1)
		tent	· ,

CHAPTER THIRTEEN WORK ZONE TRAFFIC MANAGEMENT STUDIES

Chapter 13 discusses the goals and objectives of a Traffic Management Analysis and the content for a Traffic Management Analysis Report. Chapter 55, the *Standard Specifications for Road and Bridge Construction*, and the *Highway Standards* provide the design criteria to be used when designing a traffic control plan.

13-1 GENERAL

13-1.01 **Purpose**

The maintenance of traffic flow during reconstruction, rehabilitation, or resurfacing of a State highway will involve traffic and worker safety, public relations with motorists, and capital costs to the Department. A well-planned method for maintaining traffic flow can minimize complaints from the traveling public and from residents and businesses along the affected route. It can also help to eliminate unnecessary capital costs to the Department. Evaluate each construction site on its own merits as to the appropriate method for maintaining traffic. Each Phase I Report should contain a Traffic Management Analysis (TMA) indicating an overall strategy for accommodating traffic during construction. The TMA should address the preferred traffic control method, alternative traffic control applications, geometric design criteria, the impact traffic will have on other facilities, local concerns, cost effectiveness of various alternatives, etc. For projects not requiring a Phase I Report (e.g., SMART, 3P, traffic signals) and for projects where the application of the *Highway Standards* will address the detailed traffic management, a TMA will not be required.

13-1.02 Traffic Control Plans (TCP)

The major differences between a TMA and a TCP is that the TCP focuses on the maintenance and protection of traffic within the construction zone; the TMA addresses project-related impacts throughout the project corridor and sometimes beyond. The TMA will include a preferred traffic control method. In general, the designer will be responsible for incorporating the TMA objectives into the TCP. Chapter 55 and Part VII discuss IDOT criteria for TCP's. If a TMA was not developed during Phase I, the designer must ensure that a reasonable transportation management strategy has been incorporated into the traffic control plans. Note that changes made during the preparation of the TCP may affect the overall TMA. For example, a lane closure that precipitates large queues on a freeway may cause traffic to divert to a nearby urban arterial. This may require signal coordination, lane widening, turn restrictions, etc., on the arterial to improve its capacity.

13-1(1)

13-1.03 Application

For many projects, the TMA not only must address the alternatives confined to the project site, but it must also evaluate the impact traffic will have on the entire corridor. Conduct an evaluation of the entire corridor on projects that have one or more of the following characteristics:

- where the project scope of work consists of major reconstruction or new construction;
- where there are high traffic volumes;
- where there may be significant detrimental impacts on mobility for either through or local trips in the corridor;
- where the facility's capacity will be significantly reduced (e.g., lane, ramp, or interchange closures);
- where alternative routing will be necessary (e.g., detour routing for hazardous materials, wide loads);
- where there will be significant impacts on local communities and businesses (e.g., emergency vehicles, school buses, postal service);
- where timing (e.g., special events) and seasonal impacts may be significant;
- where there will be significant grade changes; and/or
- where no alternative routes are available.

Where a series of proposed projects are along the same corridor or along corridors of close proximity, consider combining the projects into a single TMA. If circumstances prohibit a single TMA, ensure that the individual TMA's are coordinated.

13-1.04 TMA Development

13-1.04(a) Procedure

The following discusses the procedures for the development of a TMA:

1. <u>Approval</u>. In general, the TMA will be approved as part of the Phase I Report. Where there is a road closure with a marked detour, forward the TMA to BDE for review and approval from the Detour Committee prior to submitting the Phase I Report. For an unmarked State highway road closure or for a road proposed to remain open by either stage construction or a runaround, the appropriate BDE field engineer will approve the

TMA. For a closed unmarked State highway, also coordinate with the local county officials prior to submittal of the Phase I Report.

- 2. <u>TMA Team Selection</u>. For large projects, a TMA team may be organized during Phase I to study the traffic control alternatives and their effect on the corridor. Section 13-1.04(b) provides guidance on the makeup and responsibilities of the TMA team.
- 3. Phase I Report. The district will incorporate the TMA recommendations into the Phase I Report. Section 13-5 discusses the contents of a TMA Report. If improvements are required to other facilities (e.g., widening of detour routes), it is important to implement these improvements as soon as practical prior to construction of the mainline facility. Allow local agencies sufficient opportunity to complete their improvements before construction on the State route begins. Agreements or concurrence may be necessary between the State and local agencies to determine cost sharing arrangements and/or approval of a local road as a detour route.
- 4. <u>Hearings</u>. No formal public involvement activity (e.g., public hearing) should occur until BDE approves the recommended alternative in the TMA Report. However, informal public involvement will be necessary during the analysis of alternatives.
- 5. <u>Design</u>. During Phase II, it will be the designer's responsibility to implement the recommendations from the approved TMA into the detailed Traffic Control Plan (TCP), which is included in the construction plans and special provisions. The designer may be required to collect additional data and conduct additional analyses. When available, consult the TMA team when design and TCP decisions dictate a revision to the proposed TMA.
- 6. <u>Construction</u>. The TMA will be implemented during construction. Any significant proposed changes to the TMA by construction or the contractor should be reviewed with the TMA team prior to implementation. For larger projects, a public relations campaign may be required to begin prior to construction. If for any reason an approved marked detour route must be altered, it must be coordinated with the Detour Committee for approval of the new detour route.

13-1.04(b) TMA Team

If it has been determined that a TMA team is required for the project, the district will initially recommend the TMA team representatives. This determination will be based on the purpose, goals, and constraints of the TMA. A well-balanced TMA team is an important ingredient for a successful project. The variety of disciplines represented presents an effective liaison group to meet the various needs of a TMA. Depending on the project logistics, the team composition will vary from project to project. The TMA team may include representatives from:

- district Design;
- district Operations;
- district Construction;
- district Local Roads and Streets;
- Central Office Bureau of Construction;
- BDE;
- Maintenance Operations Section;
- Traffic Operations Section;
- Bureau of Local Roads and Streets;
- Office of Planning and Programming;
- Office of Public Affairs;
- Division of Public Transportation;
- FHWA;
- local government (county and/or city);
- major employers and other private companies; and
- others as deemed necessary (e.g., State Police, hospitals).

The anticipated traffic impacts will dictate the extent and nature of the TMA team's responsibilities. These may include all or part of the following functions:

- collecting data (e.g., traffic counts, crash history, roadway geometrics, proposed developments, operating speeds);
- conducting analyses (e.g., capacity analyses, traffic impact studies, safety studies, queuing analysis, geometric adequacy);
- reviewing design alternatives;
- reviewing traffic control alternatives;
- reviewing the adequacy of alternative routes (e.g., geometrics, capacity, safety, structural, roadway widths);
- reviewing on-site and off-site traffic operational improvements (e.g., signal improvements, parking restrictions, radius improvements);
- reviewing construction phasing and scheduling alternatives;
- determining the cost of various options and improvements;
- determining which options are the most cost effective;
- coordinating with local officials and businesses;

- researching local traffic demand for effects of seasonal and special events;
- coordinating funding and timing with other projects within the corridor;
- coordinating the design with other TMA plans in the region;
- planning for emergency responses (incident management);
- planning rideshare and transit strategies;
- providing recommendations for the Phase I report;
- reviewing design and TMA changes made by the designer to ensure they meet the TMA objectives;
- reviewing proposed changes made by the contractor or resident engineer during construction; and
- where necessary, developing a final report on the successes and problems of the TMA.

13-2 TRAFFIC CONTROL MANAGEMENT

13-2.01 Terminology

The following definitions are used to define the time length for work zones:

- 1. <u>Long-Term Stationary Work Zone</u>. A construction, maintenance, or utility work site that requires traffic control in the same location and where the activity requires longer than three days.
- 2. <u>Intermediate-Term Stationary Work Zone</u>. A construction, maintenance, or utility work site that requires traffic control in the same location and occupies a location from overnight to three days.
- 3. <u>Short-Term Stationary Work Zone</u>. A construction, maintenance, or utility work site that requires traffic control in the same location and where the activity takes from one to twelve hours.
- 4. <u>Short-Duration Work Zone</u>. A construction, maintenance, or utility work site that occupies a location up to one hour.
- 5. <u>Mobile Work Zone</u>. A construction, maintenance, or utility work site that is continuously moving during the period when work is actively in progress.

13-2.02 Work Zone Type

There are several basic work zone types that may be considered in a TMA. Except for roadway shifts, work sites which are completely off the roadway and do not disrupt traffic are not addressed because they will generally not have a major effect on traffic. The main function of these work types is to "relocate traffic flow" so that the construction work can proceed with minimum interruption and hazard to the workers and to the motorists. The most common projects where relocating traffic flow may be a factor include:

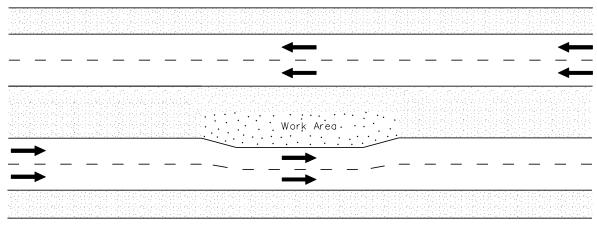
- bridge reconstruction, rehabilitation, or replacement;
- major pavement rehabilitation of existing highways;
- pavement removal and replacement;
- horizontal alignment change; and
- vertical alignment change.

The following presents a description for several work zone applications:

1. <u>Lane Constriction</u>. This work zone type is configured by reducing the width of one or more lanes to retain the number of lanes normally available to traffic. An example of lane constriction is shown in Figure 13-2A. This application is the least disruptive of all

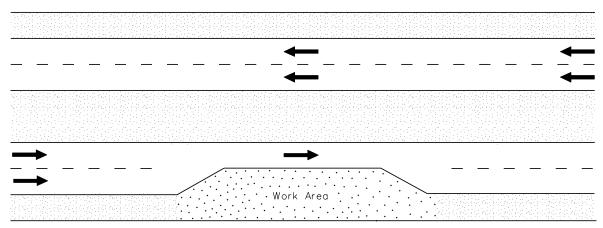
work zone types, but it is generally only appropriate if the work area is mostly outside the normal traffic lanes. Note that narrow lane widths may reduce the facility's capacity, especially where there is significant truck traffic. The use of shoulders as part of the lane width helps reduce the amount of lane width reduction that may be required; however, check the structural adequacy of the shoulders. Where this application is applied to long-term work zones, it will require the removal of the current lane markings to avoid motorist confusion. Chapter 55 discusses the minimum lane widths that must be provided.

- 2. <u>Lane Closure</u>. This work zone type closes off one or more normal traffic lanes. A lane closure example is shown in Figure 13-2B. Capacity and delay analyses may be required to determine whether serious congestion will result from lane closures. In some cases, use of the shoulder or median area as a temporary lane will help mitigate the problems arising from the loss in capacity. Upgrading or replacement of existing pavement or shoulder, or placement of temporary pavement may be necessary.
- 3. <u>One-Lane, Two-Way Operation</u>. This work zone type involves utilizing one lane for both directions of traffic. Figure 13-2C illustrates a one-lane, two-way operation work zone. This work zone type is typically only used on bridges or small, short-term projects. Flaggers or traffic signals are normally used to coordinate the two directions of traffic.
- 4. Runaround. This work zone involves the total closure of the roadway (one or both directions) where work is being performed and the traffic is rerouted to a temporary roadway constructed within the highway right-of-way. A runaround example is shown in Figure 13-2D. This application may require the acquisition of a temporary easement and usually requires extensive preparation of the temporary roadway. Generally, temporary runarounds are designed for a posted speed reduction of no more than 5 mph to 15 mph below the existing posted speed of the route. Chapter 55 discusses the minimum geometric design criteria for runarounds.
- 5. <u>Intermittent Closure</u>. This work zone type involves stopping all traffic in one or both directions for a relatively short period to allow the work to proceed. This application is illustrated in Figure 13-2E. After a specific time, depending on traffic volumes, the roadway is re-opened and all vehicles can travel through the area. This application is normally only appropriate on low-volume roadways or during periods where there are very low volumes (e.g., Sunday morning, nighttime).
- 6. <u>Use of Shoulder or Median</u>. This work zone type involves using the shoulder or the median as a temporary traffic lane. Figure 13-2F illustrates an example of using the shoulder and median. To use this technique for more than a short period, it will be necessary to evaluate the shoulder and subgrade to see if it is adequate to support the anticipated traffic loads. This technique may be used in combination with other work zone types or as a separate technique.



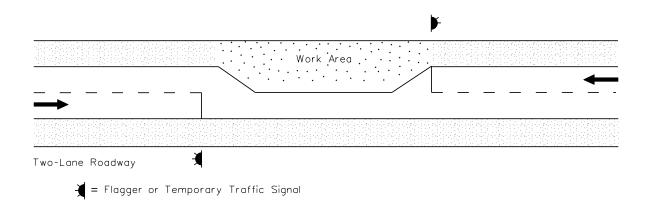
Four-Lane Divided Highway

LANE CONSTRICTION WORK ZONE Figure 13-2A

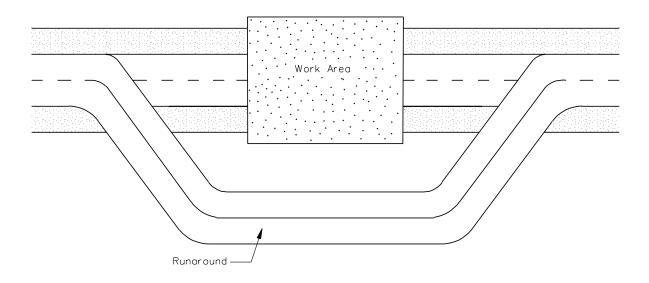


Four-Lane Divided Highway

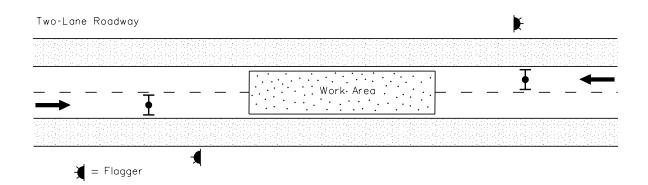
LANE CLOSURE WORK ZONE Figure 13-2B



ONE-LANE, TWO-WAY OPERATION WORK ZONE Figure 13-2C

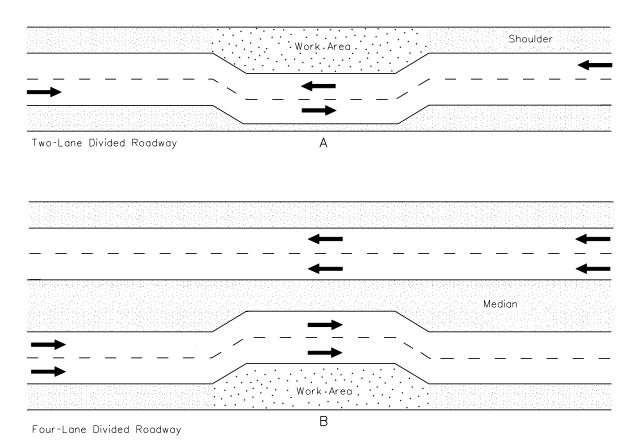


RUNAROUND WORK ZONES
Figure 13-2D



INTERMITTENT CLOSURE

Figure 13-2E



SHOULDER OR MEDIAN USE WORK ZONES

Figure 13-2F

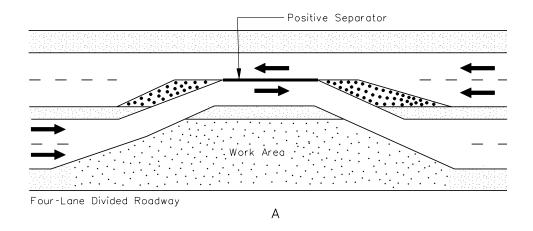
7. Two-Way Traffic on Median Divided Facility with Crossover. This work zone type involves routing one direction of the traffic stream across the median to the opposite traffic lanes. This application might also incorporate the use of shoulders and/or lane constrictions to maintain the same number of lanes. Figure 13-2G illustrates examples of crossovers. Due to the inherent high traffic volumes and, in most cases, higher speeds, it will be necessary to consider higher geometric criteria due to the higher motorist expectations.

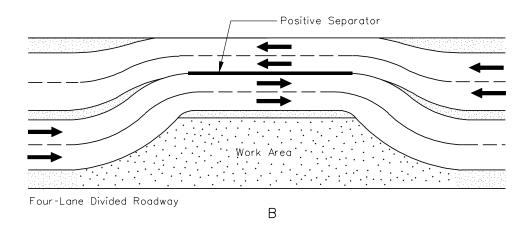
The use of this application is encouraged under the following conditions:

- all safety issues can reasonably be addressed,
- construction time can be reduced,
- pavement and shoulder structures can be reasonably upgraded, and
- roadway geometrics allow crossover construction.

Chapter 55 and the *Highway Standards* discuss the design issues relative to designing two-way applications and crossovers (e.g., maximum length, pavement widths, pavement design, speed reductions). If this application is used, separate opposing traffic on high-speed facilities (i.e., posted speeds of 45 mph or greater) with positive barriers throughout the length of the two-way operation. Drums, cones, or vertical panels may be substituted for positive barriers in low-speed urban situations. The *Highway Standards* also depict the channelization devices that may be used with this layout. Consider also the option of reconstructing the shoulder to allow it to be used as a travel lane.

- 8. <u>Detour</u>. This work zone type involves total closure of the roadway, one or both directions, when work is being performed and rerouting the traffic to existing alternative facilities. This application is particularly desirable when there is unused capacity on roads running parallel to the closed roadway. When considering detours, evaluate the following:
 - a. <u>Local Route Detours</u>. Local route detours are generally used in conjunction with the rehabilitation or reconstruction of two-lane, two-way State-maintained highways having an ADT less than 5000 vpd. However, a local route (e.g., county highway, township road, municipal street) may require upgrading (structurally and/or geometrically) or extraordinary maintenance to carry the anticipated temporary increase in traffic and to restore it subsequent to the detour. When investigating the practical use of a local road as a detour route, note that the detour route only will be temporarily serving the through traffic. If the local route detour will be an economically reasonable alternative, make every effort to use the existing roadway width, the existing right-of-way, and to minimize any contemplated utility adjustments. Also, investigate the local route to determine the safe detour speed. Where the posted speed of the detour route is





CROSSOVER WORK ZONES
Figure 13-2G

less than that of the detoured route, additional speed signs and warning devices may be required. Contact officials having jurisdiction over the local route and obtain their concurrence prior to using the route for a temporary detour.

- b. <u>Marked State Routes</u>. For marked State routes with ADT's greater than 5000 vpd, locate the detour along other marked State routes. Note that the adverse effects listed below and those for local detour routes also may apply to these detour routes.
- c. <u>Location</u>. The beginning and end of all detours should coincide as near as possible with the beginning and end of the construction project. Where practical, avoid long detours that will bypass entire communities.
- d. <u>Pedestrians</u>. Evaluate pedestrian traffic concerns and methods of eliminating or minimizing any other adverse effects when closing a road. Adverse effects could include inadequate access to buildings, private property, or businesses along the closed road.
- e. <u>Railroad Crossings</u>. Examine railroad crossings to see if existing protective devices, sight distances, geometrics, and crossing surfaces are adequate for the proposed traffic.
- f. <u>Wide Load Restrictions</u>. Determine if there will be a need to post advance signs to prohibit wide loads from utilizing the detour.
- g. <u>Split Detours</u>. In some cases, it may be advantageous to provide two detours routes a marked State route detour and a local route detour. Through traffic and heavy-truck traffic is detoured onto State-marked, high-type surface highways. The local route detour is for local traffic and vehicles weighing less than 25,000 pounds (11,000 kg). This limit will allow school buses to use the local route detour.
- h. <u>Benefits</u>. Note that improvements to local routes provide a permanent benefit for the public, whereas runarounds provide only temporary benefits that cease when the construction project is completed.
- 9. Roadway Shifts. This work zone type shifts the proposed roadway alignment laterally, (e.g., 50 ft (15 m), 100 ft (30 m)) so that the existing roadway or bridge can be used as the means to maintain traffic flow at the work site. This is an option that is usually only appropriate at horizontal curve locations, or bridge sites where the roadway profile gradeline must be raised for hydraulic purposes. Note that additional right-of-way or easements will often be necessary for this work zone type.

10. Work During Non-Peak Hours. When high-volume projects do not have good alternatives for 3R type work, consider requiring work during non-peak hours and/or night work.

13-2.03 Work Zone Traffic Control Strategies

13-2.03(a) Objectives

The desired objectives to consider in relocating traffic flow are:

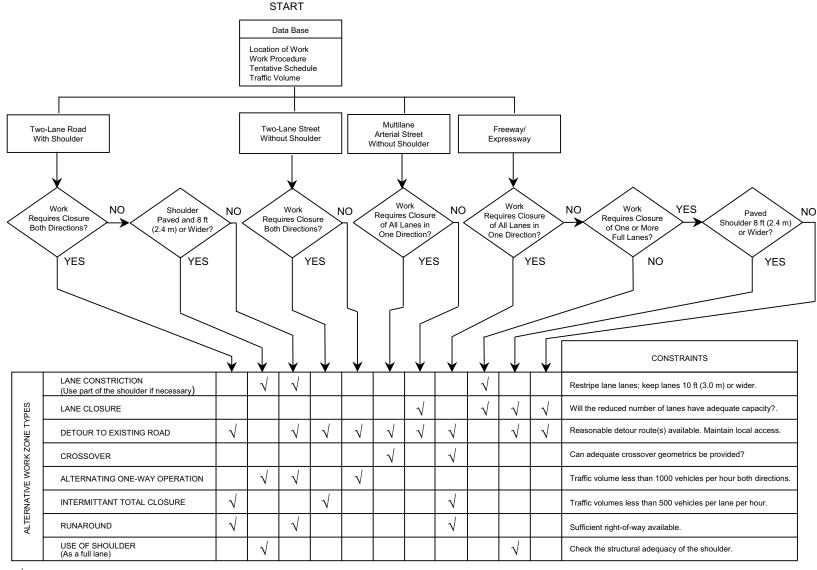
- Remove traffic from the work site. This option usually reduces the Department construction costs. With this option, sufficient space should be available for the contractor to perform the work with reasonable economy and safety.
- Avoid unreasonable adverse travel and public inconvenience.
- Ensure that only reasonable delays will be caused for emergency vehicles, school buses, mail carriers, etc.
- Maintain reasonable access for local interests (residents, businesses, agriculture, etc.).
- Maintain marked route continuity to avoid motorist confusion and to enhance safe travel.

13-2.03(b) Selection

Selection of the appropriate work zone type represents one of the most significant elements of a control strategy. Other elements of a control strategy that should be considered include length of the work zone, time of work, number of lanes, width of lanes, traffic speeds, and right-of-way. Considering these and other factors, reasonable alternatives can be narrowed to a selected few for further review. Typically, only a small number of reasonable work zone alternatives will emerge for a particular project and, in many cases, only one may be practical. Identification of these alternatives at an early stage in the planning process can reduce significantly the necessary analysis effort.

Figure 13-2H provides guidelines for identifying practical work zone alternatives based on roadway type, lane closure requirements, shoulder width, traffic volume, and the availability of right-of-way and detour routes. However, every work zone location will have a wide variation of conditions and an all-inclusive selection matrix is not practical. Other issues to consider include the following:

Illinois



[√] Practical Alternatives

IDENTIFICATION OF FEASIBLE WORK ZONE TYPES

Figure 13-2H

- 1. <u>Local Regulations</u>. Many jurisdictions have adopted safety regulations and public convenience policies as safeguards against the unacceptable impacts of work zones. These regulations and policies may impose additional constraints regarding the types of control strategies that can be implemented. Knowing these constraints can help eliminate impractical alternatives from consideration. The public convenience policies or local regulations may specify peak-hour restrictions, access requirements, noise level limitations, material storage and handling, excavation procedures, work zone lengths, and number of traffic lanes that must remain open.
- 2. <u>Multilane Facilities</u>. Traffic on multilane facilities is usually maintained through the use of lane constrictions, lane closures, or median crossovers. Maintaining traffic flow on multilane facilities generally will require higher criteria than those used on the rural two-lane highway system because of the higher speeds and traffic volumes. See the *Highway Standards* and Chapter 55 for recommended design guidelines.
- 3. <u>Bridges</u>. Traffic maintenance for bridges may consist of crossovers, stage construction (partial closure), detours, runarounds, or split detours. Coordinate all proposed designs with the Bureau of Bridges and Structures to determine their feasibility. In addition, consider the following:
 - a. <u>Crossovers (Full Closure)</u>. Consider using crossovers with bridge and superstructure replacements and deck replacements on multilane median divided facilities.
 - b. <u>Stage Construction (Partial Closure)</u>. Stage construction for bridges will generally consist of lane constrictions, lane closures, or one-lane, one-way operations. However, stage construction may increase unit costs, increase the difficulty of reconstructing the bridge, have inherent hazards due to close proximity of traffic to the construction operations, and generally involves a restricted lateral clearance for vehicles, wide loads, and farm equipment. With lateral restrictions, it is important that these restrictions be adequately marked in advance of the work site. Consider the following factors when determining the feasibility of stage construction for bridges:
 - type, length, and width of present and new structure;
 - beam spacing and location in relation to the desirable staging limits;
 - lane and shoulder widths required during stage operations; this may require using the shoulder as part of the lane;
 - the use of temporary traffic signals; and
 - cost attributable to staging.

Deck repairs can usually be staged for all structure types. Superstructure and deck replacement, however, is sensitive to the type of structure involved. Existing multi-beam superstructures (e.g., steel I-beams, concrete I-beams) and culverts can usually be adapted to construction staging techniques. Other types of structures (e.g., pony trusses, relatively short-span structures utilizing low trusses without cross bracing) may be staged, but with greater difficulty and expense. Some structures (e.g., through trusses, through girders) cannot practically be staged.

- c. <u>Runarounds</u>. At locations where a through truss, pony truss, or steel through girder is being replaced, consider moving the truss or girder laterally to temporary abutments and using the structure as a part of the runaround.
- d. <u>Split Detours</u>. If significant through traffic is using the road, it may be advantageous to provide a marked detour route around the work site and build a low-water runaround across a stream for local access. This option is usually applicable only on low-volume unmarked rural highways with less than 400 vehicles per day. See the *Bureau of Local Roads and Streets Manual* for design considerations and Section 404 permit requirements.
- 4. <u>Additional Guidance</u>. For additional guidance in analyzing and preparing a scheme to maintain traffic flow at work sites, see the *Highway Standards*, *Illinois Manual on Uniform Traffic Control Devices*, *Standard Specifications*, and Departmental Policy TRA-1 "Traffic Control Through Construction and Maintenance Areas."

13-3 TRAFFIC MANAGEMENT ANALYSIS STRATEGIES

In addition to the traffic control strategies discussed in Section 13-2, the following sections provide brief summaries of the various Traffic Management Analysis (TMA) strategies that may be considered during the development of a TMA. These strategies must be reviewed and adjusted to meet each project location and situation. Note that the strategies discussed in these sections are not all inclusive and that other options may be applicable for the location under consideration.

13-3.01 Construction Phases

How a project is constructed can greatly impact the traffic flow through the work area. The following sections discuss some of the basic construction phases for freeways.

13-3.01(a) Reconstruction by Halves (Sides)

This approach involves the reconstruction of all lanes in one direction while the opposing lanes share the same roadway with traffic in the other direction. This basic concept is the two-way traffic on a divided facility discussed in Section 13-2.02. For high volume four-lane facilities, both shoulders may be rebuilt to provide four reduced-width lanes. For six-lane facilities, traffic is generally restricted to two lanes in each direction. This may require using the shoulders, reducing the lane widths, and/or providing minor widening. Under certain circumstances, depending on the median width and shoulder configuration, the inner lane of the two-way operation may not be readily accessible in the event of emergencies. Providing for emergency turnouts and/or emergency vehicle access at appropriate intervals on the segment under construction may be considered. Some advantages and disadvantages of this strategy include:

Advantages

- It provides an effective work area.
- Generally, workers are well separated from the traffic stream.
- Work site access can be arranged with minimal interference from the general traffic flow.

<u>Disadvantages</u>

- Crossovers are typically required.
- Positive separation of the traffic streams is required.
- There are potential emergency access problems throughout the project.
- There may be special problems at interchanges with traffic crossing the work zone.
- Reduced capacity.

13-3.01(b) Parallel/Adjacent Reconstruction

This approach usually involves a variety of lane constriction and lane closure sequences discussed in Section 13-2.02. A typical sequence of this approach is as follows:

- 1. Phase A. First, the existing shoulders are widened and strengthened if necessary.
- 2. <u>Phase B.</u> Traffic is shifted to the shoulders to allow construction of the inner lanes and any median reconstruction.
- 3. <u>Phase C.</u> Traffic is then shifted to the newly constructed inner lanes to allow reconstruction of the outer lanes.
- 4. <u>Completion</u>. After construction is completed, traffic is returned to the original travel lanes.

A key advantage of this strategy is that traffic is not required to cross over the median and does not operate in a two-way operation. Some of the disadvantages include:

- Typically, it provides a more constrained work area for the contractor.
- Work crews are generally closer to moving traffic.
- Access to the construction zone typically involves entry and exit from the travel lanes.

For six-lane facilities, the facility is generally reduced to two-lanes in each direction and the above sequence is used. When closing the middle lane, it is preferable to keep the two through lanes on the same side of the construction zone (e.g., by using the shoulder) versus splitting the two lanes on either side of the construction zone.

13-3.01(c) Serial/Segmental Reconstruction

This strategy consists of permitting only short segments of the facility to be under construction at one time. This also requires one or more of the other concepts for traffic accommodation. An example of this application may include a shallow culvert replacement where each half can be constructed, backfilled, and opened to traffic within a 12-hour time period.

The advantages of this approach include relatively short work zones and few, if any, interchanges are impacted at any one time. One of the more serious disadvantages of this strategy is that the overall time period that the facility is under construction may be lengthened considerably because the construction for each segment will proceed independently. Therefore, the exposure to the potentially hazardous conditions of a work zone for both the traveling public and the work force may be substantially greater than could be the case with one of the other strategies.

13-3.01(d) Complete Closure (Detour)

In some circumstances, complete closure of the facility or closure of one direction of travel and detouring the traffic onto an alternative route may be an effective strategy. This strategy may also be effective for only certain hours of the day (e.g., 8 p.m. to 6 a.m. on weekdays and from 8 p.m. to 8 a.m. on weekends). Section 13-2.02 discusses other issues relative to detours. Some of the advantages and disadvantages of this strategy include:

<u>Advantages</u>

- Increases the safety for construction workers.
- Generally provides cost and time savings.
- Reduces the overall travel impacts to the public due to reduced construction time.

<u>Disadvantages</u>

- Potentially significant short-term travel impacts to the public.
- Potential increase in traffic congestion on other routes.
- May need to construct a detour/runaround.
- Potential adverse impact on businesses due to trip suppression (not enough traffic).
- Potential adverse impact to businesses on alternative routes (too much traffic).

13-3.01(e) Combinations

Often, a combination of construction sequences is the best strategy. For example, reconstructing existing shoulders prior to initiating parallel construction activities. The following sequence of construction could be utilized:

- 1. <u>Phase A.</u> Reconstruct shoulders as appropriate to allow one side of the roadway to accommodate four lanes.
- 2. Phase B. Shift traffic to the four available lanes on one side of the roadway.
- 3. <u>Phase C.</u> Shift traffic to the newly constructed side of the roadway using the additional reconstructed shoulder lane.

Other combination-type construction sequences involve the reconstruction of interchanges where both sequential and parallel activities may occur simultaneously.

13-3.02 On-Site Strategies

13-3.02(a) Traffic Control Devices

Consider the application of the following traffic control devices when developing a TMA:

- 1. <u>Changeable Message Signs</u>. These devices may be used where static sign messages are not sufficient to accommodate the changing conditions of a work zone (e.g., lane closures, ramp closures, to advise motorists of conditions for which they will need to possibly react).
- 2. <u>Additional Informational Panel Signs</u>. These signs may be used to give the motorists additional information about a work zone. Ensure the message on these signs is pertinent to the likely conditions the motorist will encounter.
- 3. <u>Signal Interconnect</u>. Interconnect traffic signals where the benefit of moving traffic through a work zone more efficiently will be enhanced by adding interconnection between the traffic signals on the system.
- Signal Timing. Revise the timing of traffic signals within a work zone to increase the capacity. Adding or deleting of signal phases may be required for changes in travel patterns.
- 5. <u>Highway Advisory Radio</u>. Use highway advisory radio where changing work zone conditions make it important to give the motorist a longer, more accurate message than could be obtained through the use of signs or other means. This option requires additional information and signing to alert motorists.
- 6. <u>Temporary Work Zone Speed Limits</u>. A reduced regulatory speed limit may be warranted where work activity may constitute a hazard to traffic or workers. Direction on alteration of work zone speed limits is provided in the current policy "Work Zone Speed Limit Signing." See the Bureau of Operations for additional guidance.
- 7. <u>Arrow Boards</u>. In construction areas, arrow boards are used to supplement conventional traffic control devices. They typically are warranted where additional warning and directional information is required to assist in merging and controlling traffic through and around the work activity. The *Highway Standards* provides additional guidance on the placement and use of arrow boards in construction zones.

13-3.02(b) Capacity

Each construction site will affect the capacity of the existing facility. The extent the roadway is occupied for work and safety purposes will determine the number of strategies required to

compensate for the loss of capacity. Consider the following capacity strategies when developing a TMA:

- 1. <u>Temporary Parking Restrictions</u>. One option to increase capacity is to restrict on-street parking that can then be used to add an additional lane or to reduce traffic conflicts. These restrictions can be during peak periods or for 24 hours/day. However, ensure that the concerns of on-street parking for local businesses have been addressed. Use of parking lanes for traffic lanes also may require geometric revisions at intersections.
- 2. <u>Restriction of Trucks</u>. Restriction of trucks may increase the facility's capacity. However, consider local and/or State ordinances and the availability and suitability of alternative routes that the restricted trucks will be required to take.
- Turn Restrictions. Eliminate or restrict turns at intersections and/or driveways to increase capacity and/or safety reasons. Turn restrictions can be during peak periods or for 24 hours/day.
- 4. Reversible or Contra-Flow Lanes. Use reversible or contra-flow lanes where there is a strong peaking traffic distribution. The use of these lanes may be limited in use due to the cost of providing and maintaining the daily switchovers. There also may be safety considerations which will require evaluation if reversible lanes are contemplated.
- 5. <u>Ramp Metering</u>. Consider using or revising ramp metering where it is necessary to control the volume of traffic entering a freeway for capacity and safety reasons. Ramp metering may be used during peak periods or for 24 hours/day. Also consider the impact ramp metering will have on the intersecting street (e.g., traffic backup).

13-3.02(c) Miscellaneous Strategies

In addition to the above sections, consider the following miscellaneous on-site strategies when developing a TMA:

- 1. Ramp Closures. The following will apply to ramp closures:
 - a. <u>Short/Intermediate Term</u>. Short- or intermediate-term ramp closures may be necessary for construction purposes. If closures are required, additional signage will be necessary to forewarn the motorist. It is recommended to post signs on the affected ramp two weeks in advance to advise motorists of the closure date(s) and/or periods of the day the ramp will be closed.
 - b. <u>Long Term</u>. Long-term ramp closures may be necessary to construct or to improve traffic flow on the mainline road. Consider the effect the ramp closure will have on emergency services, local access, and businesses before deciding on a long-term ramp closure. Also evaluate the user costs for a detour route and

the capacity and safety impact of the detour route. Do not close two adjacent ramps at the same time unless necessary for safety reasons.

- Incident Management. Consider the use of on-site tow trucks for freeway work zones
 with limited or no shoulders available. They should also be considered where a crash or
 break-down will seriously impact the roadway and cause significant backups and delays.
 Consider providing turnarounds for access through temporary concrete barrier and for
 tow trucks and State police to park.
- 3. <u>Special Materials</u>. Examine the use of high early strength concrete, precast items or other special materials where traffic restrictions must be minimized (e.g., ramps, intersections, high-volume roadways).
- 4. <u>Police Patrols for Speed Control</u>. Police patrols in work zones may be required to ensure vehicular speeds are at or below the posted speed or for other safety reasons. This typically will require coordination with BDE and the Bureau of Operations.
- 5. <u>Incentives/Disincentives</u>. Consider adding incentive/disincentive provisions to minimize the time a facility may be affected by construction. The contractor is provided additional funds if the project is completed early or is assessed damages if the project is not completed on time. Section 66-2.04 discusses when incentive/disincentive provisions should be considered.
- 6. <u>Pedestrians</u>. In urban or suburban areas where pedestrian activity is likely, pedestrian access must also be provided during construction. This may require providing temporary sidewalks, protection from drop offs, adjustment to traffic signals, etc. See Chapter 58 for ADA accessibility requirements that may also be applicable to construction zones.

13-3.03 Off-Site Strategies

Where construction will significantly impact the traffic flow away from the work zone, consider the following off-site strategies in the TMA:

- Advance Informational Panel Signs. These signs may be used to give the motorists
 additional information about a work zone that is ahead or on a different route. Provide
 these signs where it is advantageous to give this information to a large number of
 motorists or where it is necessary to inform motorists of an alternative route to avoid a
 congested work zone.
- 2. <u>Changeable Message Signs</u>. These devices can be used to give the motorists information required to prepare them for upcoming changing conditions or information about how to avoid a condition. Consider these devices where static messages are generally not appropriate.

- 3. <u>Signal Interconnect</u>. Evaluate interconnecting traffic signals where moving traffic through an alternative route corridor more efficiently is enhanced by adding interconnection between traffic signals on the alternative route system.
- 4. <u>Signal Timing</u>. Evaluate traffic signal timing changes and/or additional phases for traffic signals on an alternative route because of the added traffic expected to use the route.
- 5. <u>Capacity Improvements</u>. Additional improvements on the alternative route may be necessary for capacity reasons to accommodate the expected diversion of traffic. Examples of capacity improvements include additional pavement width, adding turn lanes, removal of parking, turn restrictions, and truck restrictions.
- 6. <u>Trailblazing to Attractions and Points of Interest</u>. Trailblazing may be necessary to guide motorists to attractions and points of interest in those circumstances where the normal route is closed or seriously restricted, or where an alternative route to the attraction or points of interest will assist traffic through the work zone.

13-3.04 Scheduling

Project scheduling can greatly affect the overall success of the TMA. For example, restrictive scheduling may be required to facilitate the opening of a highway prior to a special event. When determining a construction schedule, consider the following:

- 1. <u>Construction Time</u>. See Section 66-2.03 for guidance on estimating the expected construction time for the project. Also, consider the following:
 - a. <u>Short Schedule</u>. A schedule to minimize construction activities and disruption to traffic may be required if motorist user costs are expected to be excessive. However, short schedules may increase the cost of the project.
 - b. <u>Longer Schedule</u>. A longer schedule of construction activities may be cost effective if it does not significantly increase the adverse impact to motorists. The contractor may offer to provide a lower price for a longer schedule.
- 2. <u>Time of Day/Day of Week Restrictions</u>. These types of restrictions may be necessary if the work zone capacity will not accommodate the expected demand during the peak periods and other measures are not as cost effective. For example, night work may be required to allow longer work hours than can be provided between morning and afternoon peaks and to decrease the excessive traffic delays or congestion associated with lane closures during the daytime.
- 3. <u>Project Phasing</u>. Project phasing or completing smaller portions of a construction project one portion at a time may be necessary to limit disruption to traffic. However, construction activity in the same area over several seasons should be discouraged.

- Combining with Other Work. Projects within a corridor may be combined or scheduled at the same time where practical, pending available funding, to minimize impacts to the motoring public.
- 5. <u>Timing</u>. Control the timing of road closures for a certain time of the year by either setting the letting date or by placing restrictions in the special provisions. Also, when closing or restricting widths on rural highways, time the closure to occur after spring planting operations have been completed and ensure that the highway is open to traffic by harvest time.

13-3.05 Public Relations/Information

For a TMA to be successful, it often requires public involvement and the revision of traveling habits. The following discusses how the public can become informed and involved in the TMA:

- 1. <u>Public Relations Campaign</u>. It is important that the public be informed initially and remains informed in a timely manner to ensure that the TMA will work. Coordinate all proposals for major construction/reconstruction projects with the Office of Public Affairs. Also, prior to implementing any detour routes or road closures, the Office of Public Affairs must be given a one-week notice. Consider the following elements of a public relations campaign where significant impacts to traffic are expected:
 - information to news media,
 - television advertisements,
 - radio advertisements.
 - IDOT internet website,
 - town meetings and informal hearings,
 - surveys and brochures to be passed out to motorists at key locations,
 - information given to motorists at rest areas and welcome centers, and/or
 - contacting local businesses with large numbers of affected employees or customers.
- Car and Van Pooling. Consider car and van pooling campaigns where it can be expected to reduce the number of vehicles through a work zone and where a successful campaign can be expected.

13-4 COST-EFFECTIVE ANALYSES

13-4.01 **General**

Failure to maintain traffic flow adjacent to the highway under construction can cause driver aggravation, adds substantial operating costs to motorists or businesses on an individual basis, and could cause unfavorable public relations for the Department. However, these considerations must be balanced against the capital costs to the Department, because limited available funds often are needed for improving other highways and bridges. Capital costs include the building and removal of a temporary runaround, using a local route detour and structurally upgrading its roadway, paying for accelerated construction progress, or providing stage construction that may result in increased unit costs. These options can add considerable costs to the overall project.

For many projects, there may be more than one option that will address the problem of traffic during construction. To determine the most appropriate option, the designer or TMA team must compare the benefits and costs of each to determine the most appropriate option. Some projects may not have alternative methods of maintaining traffic. In these cases, the user cost calculations will generally not be required. However, for projects with incentive/disincentive clauses, the user costs must still be determined.

13-4.02 Cost Evaluations

13-4.02(a) On-Site

When determining the cost for on-site options (e.g., runarounds, lane closures, crossovers, shoulder use), the designer should consider the following:

- right-of-way costs (temporary and permanent);
- additional construction costs;
- environmental effects:
- vehicular delay;
- user costs (including detour user costs; see Section 13-4.02(c)); and
- crash potential.

When determining the effect of each on-site option, the designer may also consider the effect the selected option will have on unofficial detours (i.e., detours which drivers select on their own to avoid the construction area).

13-4.02(b) Detours

For detours, the designer must determine the total cost of the detour. This includes:

Illinois

- detour user costs; see Section 13-4.02(c);
- the cost for any improvements needed to the detour route (e.g., repaving, pavement widening, signal improvements);
- the effect the detour will have on the community and local businesses; and
- the effect on the local street network.

13-4.02(c) Detour User Costs

Adverse travel is the additional distance that motorists must travel to complete their trips around the work site while a detour is in use. To reduce project construction costs to the Department and to enable these savings to be used for other needed improvements, it is considered in the best interests of the public for road users to directly share in the costs of road and bridge improvements. Road users will bear some of the costs of reasonable adverse travel. Accordingly, this should be reflected during preparation of the TMA. Multiply the computed adverse travel costs by 0.5 before making any comparisons to the costs of other alternative methods of maintaining traffic flow.

Breakout the cost according to the following:

- 1. <u>Cars, Pickups, and Vans</u>. When computing operating costs for cars, pickups, and vans, the following publications may be used as a guide to determine the per mile (km) costs:
 - Cost of Owning and Operating Automobiles and Vans prepared by the Federal Highway Administration,
 - Car Study prepared by the Hertz Corporation, or
 - Your Driving Costs published by the American Automobile Association and available from Chicago Motor Club offices.

Only the variable costs need to be considered in computing per mile (km) costs which include:

- gasoline and oil;
- maintenance, accessories, parts, and tires; and
- State and Federal taxes on the above.

Fixed costs (e.g., insurance, depreciation, license fees, finance charges) need not be considered because they are incurred whether or not a vehicle is driven extra miles (km).

- 2. <u>Trucks</u>. For truck operation costs, review the *Cost Summary Booklet* published by the Midwest Truckers Association. Only the variable costs need to be considered in computing per mile (km) costs for trucks. These costs include:
 - diesel fuel for tractor-trailer units and gasoline or diesel fuel for single-unit trucks;
 - tires;
 - maintenance (oil, grease, and repairs);
 - driver's wages and fringes; and
 - operating depreciation.

Fixed costs (e.g., tractor or trailer replacement costs, Federal highway use tax, license fees, insurance, finance charges) need not be considered because they are incurred whether or not the vehicle is driven extra miles (km).

For any additional information on adverse travel costs or on the above listed publications, contact BDE.

13-5 TRAFFIC MANAGEMENT ANALYSIS REPORT

A Traffic Management Analysis (TMA) is required on all projects requiring road closure, detours, crossovers, lane shifts, or overnight lane closures. Projects requiring only daytime lane closures with flaggers will not necessitate TMA reporting.

13-5.01 **Submittals**

The following will apply:

- Road Closure. If a road will be closed, submit six copies of the TMA Report, accompanied by a map designating the location of the improvement and the various detour alternatives, to BDE. BDE will retain one copy and transmit the other copies to the appropriate individuals for review. Submit the road closure TMA Report to BDE for review and approval prior to submitting the Phase I report.
- 2. <u>Non-Closure</u>. If a road will remain open by either stage construction or by a runaround, only submit a copy of the TMA in the project report to BDE for design approval.

13-5.02 Report Content

Include the following information in the TMA Report:

- 1. <u>Summary</u>. Include a statement in the beginning of the Report describing the proposed improvement, its location, and when construction is anticipated.
- 2. <u>Traffic Characteristics</u>. Note the expected ADT on the facility during construction, the functional classification of the road, and the percentage breakdown for each vehicular type. Also, segregate the traffic volumes according to the following:
 - a. <u>Through Traffic</u>. Note the amount of through traffic within the construction zone. This is defined as traffic whose origin and destination is beyond the limits of the planned work site.
 - b. <u>Local Traffic</u>. Indicate the amount of local access traffic within the construction zone. This is defined as traffic having its origin or destination (or both) within the limits of the planned work zone.

The breakdown between through traffic and local traffic may be estimated or taken from records already available. It should be anticipated that a portion of the present ADT will independently disperse to alternative routes of its own choosing rather than using the designated detour. Origin and destination surveys will not be required except in cases where the district determines they are necessary.

- 3. <u>Design</u>. If it is proposed to maintain traffic flow around work sites by stage construction, crossovers, runaround, or local road detour, the TMA Report should address the design information included in Chapter 55.
- 4. <u>Alternatives</u>. List and describe all the practical alternatives considered; see Section 13-2.02. Note the preferred recommendation and list the reasons for this recommendation. In addition, each alternative discussion should address:
 - a. <u>Travel Distance</u>. The adverse travel distance involved in the alternative and its economic effects on motorists. For user costs, see Section 13-4.02(c).
 - b. <u>Traffic Flow</u>. Address how traffic flow will be maintained around or through the work site.
 - c. <u>Time</u>. Note the length of time the traffic will be affected.
 - d. <u>Responsible Agency</u>. Identify each agency which is responsible for the maintenance of each alternative.
 - e. <u>Cost</u>. Provide a total cost estimate for each alternative. This should include the cost for major construction items, maintenance, right-of-way, and utilities. When a runaround will be used, include an estimate for any significant salvageable materials.
 - f. <u>Summary Table</u>. Include a summary table that compares the total costs for the various alternatives.
 - g. <u>Itemized Costs</u>. Where applicable, show the itemized costs for the recommended alternative.
- 5. <u>Coordination</u>. Discuss any coordination that was conducted with those who have input into the project or may be significantly affected by the project. This may include:
 - a. <u>Local Organizations</u>. List any discussions conducted with emergency services, school districts, mass transit districts, local post offices, grain elevators and fertilizer businesses, recreational facilities, farmers, local businesses, and local agencies responsible for law enforcement and medical services.
 - b. <u>Local Officials</u>. Include the results of any coordination with county officials, township highway commissioners, municipal officials, other local governmental agencies, and railroad or utility companies.
 - c. <u>State and Federal Agencies</u>. Describe all coordination with any outside State and Federal agencies. For example, the coordination with the Illinois Department

of Natural Resources and Army Corps of Engineers relative to mitigation procedures for in-stream work; see Section 22-5.